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Improving pension product design

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Abstract

Pension products characterized by linking an individual's savings directly to market returns represent the most popular, growing pension domain globally. These products are widely sold in contribution-defined pension schemes, labor market pensions, and individual schemes. For instance, in Denmark, there are almost 53 billion EUR invested in these products. However, available products are designed with a tendency to assume greater risk the longer it is until retirement, but are not adjusted to individual preferences and circumstances.

This paper develops an optimal asset allocation strategy, retirement benefits and insured sum for a defined contribution plan by adjusting to individual needs, such that the expected utility of total retirement benefits and the utility of leaving money upon death are maximized. The benefits consist of three sources of payments: state pension, labor market pension and private pension. We argue that the controlled processes should not only depend on the plan member's age (or time left to retirement), nor only on her risk preferences, but should capture personal characteristics. Among other factors, we include current wealth, expected lifetime salary progression (mandatory pension contributions), voluntary pension contributions, expected social benefits, choice of assets, type of retirement distribution schedules, marital status and bequest motive.

The problem is solved via a model that combines two optimization approaches: stochastic optimal control and multi-stage stochastic linear programming (SLP). The first method is common in financial and actuarial literature, but results in theoretical values. However, SLP, which is characteristic for operations research, has highly practical application. As an example of an optimal pension product design, we present the operations research methods, which have potential to stimulate new thinking and add to actuarial practice.